REMARKS

Applicants have amended their claims, concurrently with the filing of a RCE Transmittal, in order to further clarify the definition of various aspects of the present invention. Specifically, claims 16-37, considered in the Final Office Action mailed July 26, 2006, have been cancelled without prejudice or disclaimer, and new claims 38-55 have been added to the application. It is to be noted that previously considered claims 1-15 have previously been cancelled without prejudice or disclaimer; and, accordingly, in the enclosed listing of claims, claims 1-37 have been indicated as having been cancelled, such canceling being without prejudice or disclaimer of the subject matter thereof.

Of the newly added claims, claims 38 and 47 are independent claims, corresponding respectively to previously considered claims 16 and 30. Note that as compared with previously considered claims 16 and 30, new claims 38 and 47 recite that each of the stirring blocks has a plurality of disks next to each other and connected to each other by rods in parallel to the rotating center around a hollow at a center of the disks, the scraping vanes disposed on its periphery portion around the rods in a space between adjacent disks, and wherein a space between the disks in a high viscosity side of the stirring blocks, where the outlet is nearer, is larger than the space between the disks in a low viscosity side of the stirring blocks, where the inlet is nearer, and each of the scraping vanes disposed on the plate portions in the adjacent disks of the high viscosity side of the stirring blocks extends discontinuously to an adjacent disk and is alternately arranged on the one disk and on another adjacent disk respectively, such that a track of one scraping vane on one disk can overlap that of the one scraping vane on another adjacent disk when these disks are rotated. Note, for example, Figs. 4 and 8, as well as, for example, pages 23-26 of

Applicants' specification, particularly the paragraph bridging pages 25 and 26 thereof.

Of the remaining newly added claims, claims 39-46 are ultimately dependent upon claim 38; and claims 48-55 are ultimately dependent upon claim 47. Claims 39-45 correspond respectively to previously considered claims 17-20 and 24-26; and claims 48-51 correspond respectively to previously considered claims 31-34. Of the remaining newly added claims, claims 46 and 55, dependent respectively on claims 38 and 47, recite that the scraping vanes are closer to the periphery of the disks than the rods are to the periphery of the disks. Claims 52-54 recite subject matter expressly set forth in claims 49-51, respectively, but are dependent respectively on claims 50, 48 and 51.

The concurrently filed RCE Transmittal for the above-identified application is again noted. It is respectfully submitted that the present amendments clearly constitute the necessary Submission under 37 CFR 1.114. Moreover, in view of the concurrently filed RCE Transmittal, entry of the present amendments is clearly proper, notwithstanding Finality of the Office Action mailed July 26, 2006.

In the concurrently filed RCE Transmittal, Applicants have requested a suspension of action on the above-identified application under 37 CFR 1.103(c), for a period of three (3) months. Such request for suspension of action is reiterated herein. Moreover, in view of payment of the fee under 37 CFR 1.17(i), submitted concurrently herewith, it is respectfully submitted that the requested suspension of action must be granted; and, accordingly, the Examiner is respectfully requested to refrain from acting on the above-identified application until after the end of this suspension period.

The objections to claims 16 and 30, set forth in Item 2 on page 2 of the Office Action mailed July 26, 2006, is moot, in light of cancelling of claims 16 and 30 without prejudice or disclaimer, and in light of newly added claim 38 and 47.

Applicants respectfully submit that all of the claims presented for consideration by the Examiner patentably distinguish over the teachings of the prior art applied by the Examiner in rejecting claims in the Office Action mailed July 26, 2006, that is, the teachings of the U.S. patents to Shaefer, et al., No. 4,100,142, and to Schnock, et al., No. 3,591,344, and European Patent Application No. EP 711,597 (Shaw, et al.), under the provisions of 35 USC 103.

It is respectfully submitted that these references as applied by the Examiner would have neither taught nor would have suggested such polyester manufacturing apparatus as in the present claims, having, inter alia, the third reactor producing a high molecular weight polyester polymerized to a higher degree than a low molecular weight polyester formed in a second reactor, the third reactor including a substantially horizontal cylindrical vessel and, inter alia, a stirring rotor provided and rotated in the cylindrical vessel of the third reactor, with the stirring rotor including a plurality of stirring blocks depending on viscosities of the low molecular weight polyester polycondensed in the third reactor, and having no shaft at the rotating center, each of the stirring blocks having a plurality of disks next to each other and connected to each other by rods in parallel to the rotating center around a hollow at a center area of the disks, with scraping vanes disposed on its periphery portion around the rods in a space between adjacent disks, the plurality of disks having a plate portion at least in its periphery portion, and wherein a space between the disks in a high viscosity side of the stirring blocks, where the outlet is nearer, is larger than the space between the disks in a low viscosity side of the stirring blocks, where the

inlet is nearer, and each of the scraping vanes disposed on the plate portions in the adjacent disks of the high viscosity side of the stirring blocks extending discontinuously to the adjacent disk and being alternately arranged on the one disk and on another adjacent disk respectively such that a track of one scraping vane on one disk can overlap that of the one scraping vane on another adjacent disk when these disks are rotated. See claim 38; note also claim 47.

Furthermore, it is respectfully submitted that the teachings of these applied references would have neither taught nor would have suggested such polyester manufacturing apparatus as in the present claims, including the third reactor, having features as discussed previously in connection with claims 38 and 47; and, moreover, wherein the stirring rotor is provided such that a film of the low molecular weight polyester is formed over the hollow by low molecular weight polyester being scooped up by the scraping vanes and flowing downward as the stirring rotor rotates (see claims 39 and 48); and/or wherein a number of the scraping vanes in a high viscosity side of the stirring blocks, where the outlet is nearer, is smaller than the number of the scraping vanes in a low viscosity side of the stirring blocks, where the inlet is nearer (note claims 40, 42, 43, 49, 51 and 52); and/or wherein an area of the hollow of the disks in a high viscosity side of the stirring blocks, where the outlet is nearer, is larger than the area of the hollow of the disks in a low viscosity side of the stirring blocks, where the inlet is nearer (see claims 41, 44, 45, 50, 53 and 54); and/or wherein the scraping vanes are closer to the periphery of the disks than the rods are to the periphery of the disks (see claims 46 and 55).

As a feature of the present invention, a space between the disks in a high viscosity side of the stirring blocks, where the outlet is nearer, is larger than at a low viscosity side of the stirring blocks, where the inlet is nearer, and each of the

scraping vanes disposed on the plate portions of the adjacent disks of the high viscosity side of the stirring blocks extends discontinuously to the adjacent disk and is alternately arranged on the one disk and on another adjacent disk respectively such that a track of one scraping vane on one disk can overlap that of the one scraping vane on another adjacent disk when these disks are rotated. According to the present invention, having the foregoing features, the treated liquid material can be stirred uniformly to obtain a high viscosity, and a size of the third reactor can be miniaturized. In particular, as specified in the above amended claims, by providing the scraping vanes disposed as in the present claims, and with rotation thereof, the treated liquor forms a liquid surface also in the peripheral direction of the rotation so that the liquid surface is complicated, which can increase evaporation from the liquid surface. As a result, in a reactor having a small liquid capacity, a large amount of treated liquid can be reacted uniformly, to produce a polyester with a high quality.

In reactors for producing a high molecular weight polyester polymerized from a low molecular weight polyester, it is required to increase polymerization degree as much as possible. Moreover, as polymerization degree increases, viscosity increases, and uniform stirring of the polyester in the third reactor is difficult so that it is difficult to provide uniform processing. Moreover, if intervals of disks are minimized with preventing formation of "bridging", the number of the disks has to be increased so that length of the stirring rotor increases, and volume of the reactor becomes larger. As a result, costs for producing and operating the apparatus becomes higher, and energy for operating the apparatus also becomes higher.

The present invention solves these problems, by not merely adjusting intervals of the disks, but by forming structure in which surface area of the treated liquid is increased in spaces between the disks. Thus, in the stirring block on the

high viscosity side, the present invention adopts structure in which each of the scraping vanes disposed on the plate portions of the adjacent disks of the high viscosity side of the stirring blocks extends discontinuously to the adjacent disk and is alternately arranged on the one disk and another adjacent disk respectively such that a track of one scraping vane on one disk can overlap that of the one scraping vane on another adjacent disk when these disks are rotated. According to the structure, the treated liquid is stirred between two disks, and hangs over between an inside edge of a scraping vane attached to one disk and an edge of another disk. As a result, surface area of the treated liquid is efficiently increased, and, in particular, the surface of the treated liquid is remarkably stretched in the direction of the disk rotation on the edge of another disk.

By the present structure, the present invention succeeds in increasing the surface of portions of the treated liquid distant from the disks, so that stirring of the treated liquid and the polymerization reaction can be uniformly carried out. Moreover, in order to reduce retention of the treated liquid which fails to be scraped by the scraping vanes, scraping vanes are arranged such that the track of one scraping vane on one disk overlaps that of one scraping vane on another (adjacent) disk so as to scrape the treated liquid totally. Furthermore, stirring between the edge of another disk and the scraping vane of one disk can be effected with less interval of the disks because the surface of the scraping vane is small so that formation of a "bridge" can be prevented more effectively than stirring between disk edges.

As a further aspect of the present invention, as illustrated in Fig. 4, there is provided structure of a plurality of disks next to each other and connected to each other by rods in parallel to the rotating center, with a hollow disposed at its center

portions and scraping vanes disposed on its periphery portion around the hollow in the space between these disks. As a further feature of the present invention, the rods are provided at periphery portions of the disks, and the scraping vanes are provided outside of the rods. Note especially claims 46 and 55. According to such structure, the stirring blocks of the high viscosity side are sufficient in rigidity of the stirring rotor, and are not deformed or damaged by large stress caused by the treated liquid having a high viscosity.

As an additional feature of the present invention, the stirring rotor includes a plurality of stirring blocks dependent on viscosity of the low molecular weight polyester polycondensed in the third reactor and having no shaft at the rotating center, each of the stirring blocks having a plurality of disks next to each other and connected to each other by rods in parallel to the rotating center, with a hollow disposed at the center area of each disk and scraping vanes disposed on its periphery portion around the hollow in the space between the disks, the plurality of disks having a plate portion at least in its periphery portion and the stirring blocks having different structures of the disks or vanes. By this feature, there can be obtained advantageous effects that a polyester can be manufactured with less energy, and improved efficiency.

In the present invention, a plate portion is provided in a periphery portion of the disk, to prevent materials having low polymerization degree (that is, low viscosity) from moving toward the outlet side from the reactor, materials between the disks being scooped up by the scraping vanes and then flowing downward with rotation of the disks. The material flowing downward becomes a thin film and hangs over the hollow portions of the disks, so that a surface area of the material at the center of the disks becomes large, thereby accelerating the polymerization reaction.

Thus, the disks themselves prevent undesirable movement of materials, by blocking movement of the materials along the direction of the axis of the reactor; and the scraping vanes scoop up the material between the disks, causing the material to hang over the hollow portions, and stir the materials sufficiently to accelerate the reaction of the materials between the disks, and prevent unevenness of polymerization. It is respectfully submitted that various of the references, having a mesh disk structure, would not block disadvantageous flow of low viscosity (low polymerization degree) material along the axis of the reactor, toward the reactor outlet; and without the scraping vanes would not achieved the desired flow, including the thin film flowing to the hollow disposed at the center area of the disks.

It is emphasized that through the stirring rotor according to the present invention, having the disks having the plate portion and the hollow, and also having the stirring vanes, and also wherein the disks are connected to each other by rods in parallel to the rotating center, the flow of material in a thin film is effectuated to improve the polymerization reaction, while the plates block undesirable movement of material, whereby both effective and efficient polymerization is achieved while preventing unevenness of the polymerization.

Accordingly, through features of the present invention, uniformity of reaction in the high viscosity side, a reduced size of the reactor, and low costs for production and operation of the apparatus, are achieved.

Schaefer, et al. discloses a process for producing polyesters, with a description of apparatus for performing such process. This patent discloses a process including directly esterifying a dicarboxylic acid with a glycol at a pressure above the partial vapor pressure of the glycol, the temperature being sufficient to allow continuous removal of water of esterification in the vapor phase, and

continuing the esterification for a time sufficient to form an oligomer mixture comprising ester and a mixture of low molecular weight polyester; esterification is continued. Following multistage esterification, high molecular weight may be developed by passage of an oligomer mixture through a plurality of zones of increasing vacuum and temperature. See column 3, line 61 through column 4, line 11. As for the apparatus described by Shaefer, et al., note, for example, column 5, lines 9-20 and 65-67; column 6, lines 27-39; and column 7, lines 12-30 and 47-53. See also the paragraph bridging columns 16 and 17 of this patent.

It is respectfully submitted that Shaefer, et al. does not disclose, nor would have suggested, such apparatus as in the present claims, including, inter alia, disposition of each of the scraping vanes and/or spacing between the disks; and/or other features of the present invention, including (but not limited to) wherein the stirring blocks have a plurality of disks next to each other and connected to each other by rods in parallel to the rotating center around a hollow at a center area of the disks, with scraping vanes disposed on its periphery portion around the rods in a space between adjacent disks, the plurality of disks having a plate portion at least in its periphery portion, and advantages thereof.

It is respectfully submitted that the secondary references applied by the Examiner, Schnock, et al. and Shaw, et al., would not have rectified the deficiencies of Schaefer, et al., such that the presently claimed invention as a whole would have been obvious to one of ordinary skill in the art.

Schnock, et al. discloses a device for the continuous polycondensation of melts, which includes a heatable, cylindrical or conical, horizontal or almost horizontal reactor provided with an inlet at one end and an outlet at the other end for the melt, and a vapor outlet, the reactor containing a stirrer adapted to the shape of

the reactor the continuous or discontinuous axis of rotation of which is congruent with the axis of the reactor. The stirrer is subdivided by a plurality of disks in vertical position with respect to its axis, the disks being provided with perforations staggered from disk to disk. This patent discloses that parallel to the axis of the stirrer a plurality of peripherally arranged, groove- or ribbon-shaped drag elements are provided. This patent discloses that when the stirrer rotates the drag elements continuously convey the melt from the bottom of the reactor onto the rod-shaped elements inside of the stirrer where it is uniformly distributed in a thin layer and from which it returns to the melt-containing sump of the reactor. Note the paragraph bridging columns 2 and 3 of this patent. See also column 3, lines 32-36 and 66-72. Note also column 3, lines 41-46, describing that instead of perforated disks, there may also be used rings alternating with disks. Note also column 4, line 68 through column 5, line 6. Note, further, column 5, lines 26-32, disclosing shapes of perforations of the disks.

Shaw, et al. discloses a reactor apparatus for use in preparing a polymeric material, the reactor apparatus including a reactor vessel defining a horizontally-extending interior polymer processing chamber, and a polymer agitator extending axially within the processing chamber and comprising an annular overflow baffle defining a central polymer overflow opening and an underflow baffle having an outer periphery defining at least one polymer underflow opening between its outer periphery and the vessel. This patent document discloses that the overflow and underflow baffles are affixed together for unitary rotation in generally parallel axially-spaced relation to one another within the processing chamber so that a portion of the flow path for the polymeric material between the polymer inlet and outlet extends through the overflow and underflow openings of the baffles. Note the paragraph

bridging columns 2 and 3 of this patent document. Note also the disclosure, in connection with a preferred embodiment, in column 3, lines 24-36. See also column 4, lines 4-13; column 7, lines 7-33; and column 11, lines 27-56, describing, inter alia, polymer wiping bars 62.

Even assuming, arguendo, that the teachings of these references as applied by the Examiner were properly combinable, such combined teachings would have neither disclosed nor would have suggested the presently claimed apparatus, including relative spacing between the disks in high-viscosity and low-viscosity sides of the stirring blocks; and/or disposition of the scraping vanes; and/or plurality of stirring blocks, as in the present invention and discussed previously.

It is respectfully submitted that the prior art structures of Shaefer, et al. and of Shaw, et al. disclose reactors provided with stirring rotors having specific structure. In these references, the stirring rotors have a rotation axis that is substantially horizontal, with treated liquid being stirred in the axis direction, and polymerization degree (viscosity) of the treated liquid increasing with the rotation of the stirring rotor. The rotor includes disks, and means for scraping the treated liquid ("wiper bar") attached to the disks with a hollow at the center area. The references further disclose that the size (area) of the hollow is formed larger with increase of viscosity of the treated liquid. Such structure as in the applied references of Shaefer, et al. and of Shaw, et al. aims to enhance evaporation of reaction products from the treated liquid having high viscosity, by increasing area of the liquid surface.

Even when the hollow area is made large to increase the surface area of the treated liquid to be charged thereinto, if the treated liquid is adhered to the disks without dropping therefrom and rotation of the disks is continued, the treated liquid is not uniformly stirred and reaction occurs only at stirred portions so that the reaction

product failed to have a uniform quality.

In the applied references, in order to solve the problem that the treated liquid is adhered to the disks owing to the increased viscosity, and the reaction products fail to have uniform quality, and in particular in order to prevent the treated liquid having high viscosity from forming bulk materials which attach to adjacent disks and rotate with the disks to form undesired "bridges", intervals of the disks in the references are increased with enhancement of viscosity of the treated liquid. However, in the structure of the references, even when means for scraping the treated liquid is disposed on periphery portions of the disks, only portions of scraped treated liquid near the disks hang over the hollow portions. Portions of the scraped treated liquid distant from the disks form "bridges", or otherwise flow to a subjacent level of the treated liquid without hanging over the hollow portions of the disks, and hence are not subjected to action of the hollow portions to increase surface area of the treated liquid. Thus, only portions of the treated liquid near the disks proceed with the reaction to obtain high degree of polymerization.

In the apparatus wherein the intervals of the disks are increased with increase of viscosity of the treated liquid, as in the applied references, larger amounts of the treated liquid fail to encounter action of the hollow portions to increase the surface area; and when intervals of the disks are prolonged in an attempt to prevent "bridges" in light of an increase of viscosity, amounts of the treated liquid flowing to the subjacent level of the treated liquid without encountering action of the hollow portions are increased. As a result, uniformity of polymerization reaction in the treated liquid is poor, in structure according to the invention.

If intervals of disks are minimized for preventing formation of "bridges", number of disks has to be increased so that length of the stirring rotor increases,

and volume of the reactor becomes larger. As a result, costs for producing and operating the apparatus becomes higher, and energy for operating the apparatus becomes higher. These problems arise in connection with structures according to the prior art.

In contrast, the present invention solves these problems, by the structure as in the present claims, including the stirring blocks and, in particular, disposition of the scraping vanes as in the present claims. According to the present invention, the treated liquid is stirred between disks, and such stirring is effective and efficient to increase surface area of the treated liquid, whereby stirring and polymerization reaction can be uniformly carried out. Such efficient stirring is particularly achieved due to scraping vanes being arranged such that the track of one scraping vane on one disk can overlap that of one scraping vane on another disk so as to scrape the treated liquid totally.

As can be seen in the foregoing, the presently claimed structure, different from that of the prior art, provides advantages.

In view of the foregoing comments and amendments, and noting the concurrently filed RCE Transmittal **requesting a three (3) month suspension of action**, entry of the present amendments, and further examination of the above-identified application subsequent to the requested suspension of action, with subsequent allowance of all claims in the present application, are respectfully requested.

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Respectfully submitted,

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